Announcements

- EXAM 3 is TOMORROW!
- NO New Homework

  CQ6: a) No b) Yes

  34.12: 6.0×10^5 N/C

  34.18: 1.2×10^{-10} W/m^2

  34.20: a) 2.2×10^{11} V/m b) 0.43

  34.22: 8.2×10^{-2} m

- Office hours…

  MW 10-11 am

  TR 9-10 am

  F 12-1 pm

- Tutorial Learning Center (TLC) hours:

  MTWR 8-6 pm

  F 8-11 am, 2-5 pm

  Su 1-5 pm

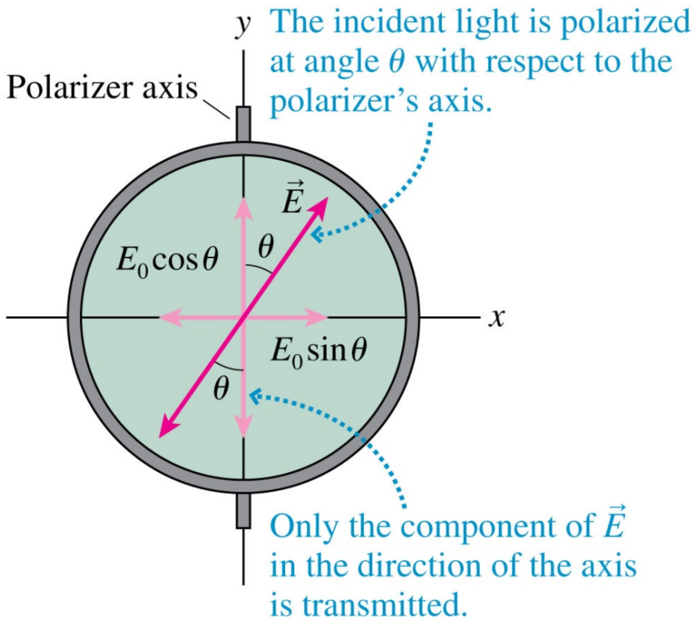
Malus's Law

Consider *polarized* light of intensity I_0 approaching a *polarizing filter*…

The component of the E-field that is polarized *parallel* to the axis is *transmitted*.

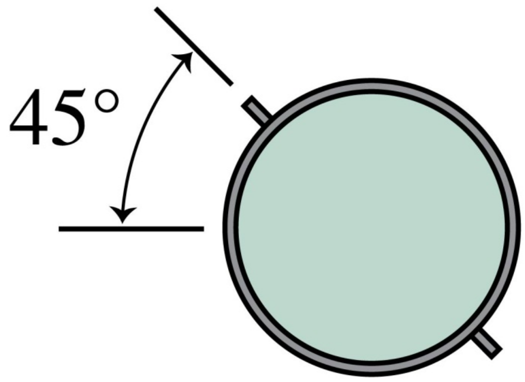
- The *transmitted intensity* is…

$$I_{trans} = I_0 \cos^2 \theta$$



Quiz Question 1

A vertically polarized light wave of intensity 1000 mW/m² is coming toward you, out of the screen. After passing through this polarizing filter, the wave's intensity is

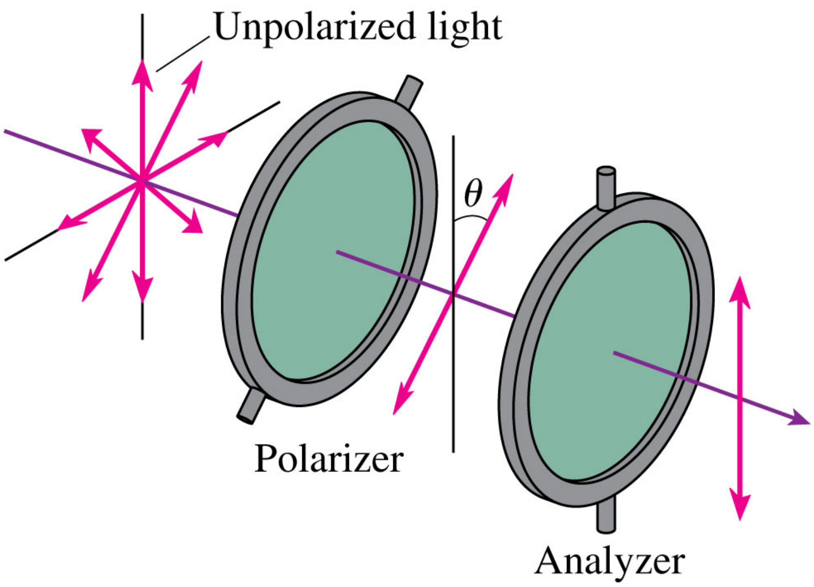


1. 707 mW/m².
2. 500 mW/m².
3. 333 mW/m².
4. 250 mW/m².
5. 0 mW/m².

Polarizers and Analyzers…

Malus's law can be demonstrated with two polarizing filters…

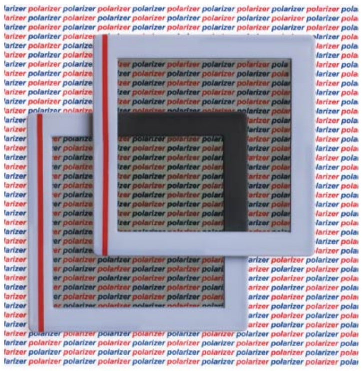
- The first, called the *polarizer*, is used to produce polarized light of intensity I_o.



The second, called the *analyzer*, is rotated by angle θ relative to the polarizer.

Polarizers and Analyzers…

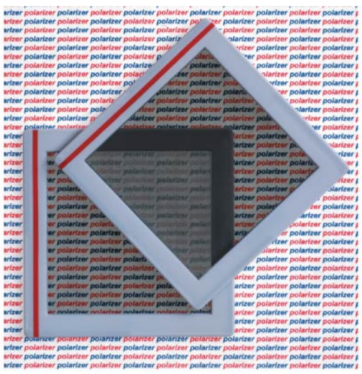
- The transmission of the analyzer is 100% when $\theta = 0°$, and steadily decreases to zero when $\theta = 90°$.
- Two polarizing filters with *perpendicular* axes block ALL the light.



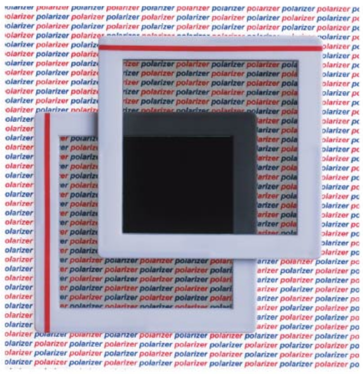
$\theta = 0°$

- If the incident light on a polarizing filter is unpolarized, *half* the intensity is transmitted:

$$I_{trans} = \frac{1}{2} I_0$$



$\theta = 45°$



$\theta = 90°$

Outline…

CH 32 – The B-Field

- Magnetism
- The Discovery of the *B*-Field
- The Source of the *B*-Field: Moving Charges
- The *B*-Field of a Current
- Magnetic Dipoles
- The Magnetic Force on a Moving Charge
- Magnetic Forces on Current-Carrying Wires
- Forces and Torques on Current Loops

CH 33 – Electromagnetic Induction

- Induced Currents
- Motional emf
- Magnetic Flux
- Lenz's Law
- Faraday's Law

CH 34 – Electromagnetic Fields and Waves

- Electromagnetic Waves
- Properties of Electromagnetic Waves
- Polarization

Ch. 32

$B_q = \frac{\mu_0}{4\pi} \frac{qv\sin\theta}{r^2}$ $\vec{B} = \vec{v} \times \hat{r}$

$B_q = \frac{\mu_0}{4\pi} \frac{q\vec{v}\times\hat{r}}{r^2}$ $\hat{r} = \hat{v}$ to point

$B_{I\,seg} = \frac{\mu_0}{4\pi} \frac{I\Delta\vec{l}\times\hat{r}}{r^2}$

$B_{wire} = \frac{\mu_0 I}{2\pi d}$ $d = \perp$ distance

$B_{Loop} = \frac{\mu_0}{2} \frac{IR^2}{(z^2+R^2)^{3/2}}$ $z = \perp$ distance, $R =$ radius loop

$B_{coil\ center} = \frac{\mu_0}{2} \frac{NI}{R}$ $N =$ Number of loops

$B_{dipole} = \frac{\mu_0}{4\pi} \frac{2\vec{\mu}}{r^3}$

$\mu = AI$

$\vec{F}_{on\ q} = q\vec{v}\times\vec{B}$, $\vec{F}_{on\ q} = qvB\sin\theta$

$\vec{F}_q = q\vec{E}$, $\vec{F} = I\vec{l}\times B$

$r_{cyc} = \frac{mv}{qB}$ $\tau = \vec{\mu}\times\vec{B}$

$F_{2\,on\,1} = \frac{\mu_0 l I_1 I_2}{2\pi d}$

$f_{cyc} = \frac{qB}{2\pi m}$

Ch. 33

$\mathcal{E} = vlB$

$I = \frac{vlB}{R}$

$F_{pull} = F_{mag} = \frac{vl^2B^2}{R}$

$P_{input} = P_{dis} = \frac{v^2l^2B^2}{R}$

$\Phi_m = \vec{B}\cdot\vec{A} = AB\cos\theta$

$\Phi_m = \int \vec{B}\cdot d\vec{A}$

$\mathcal{E} = \left| \frac{d\Phi_m}{dt} \right|$

Ch. 34

$E = cB$

$c = 3.00\times10^8\ m/s$

$\vec{S} = \frac{1}{\mu_0} \vec{E}\times\vec{B}$

$I = \frac{P}{A} = \frac{1}{2}c\epsilon_0 E_0^2$

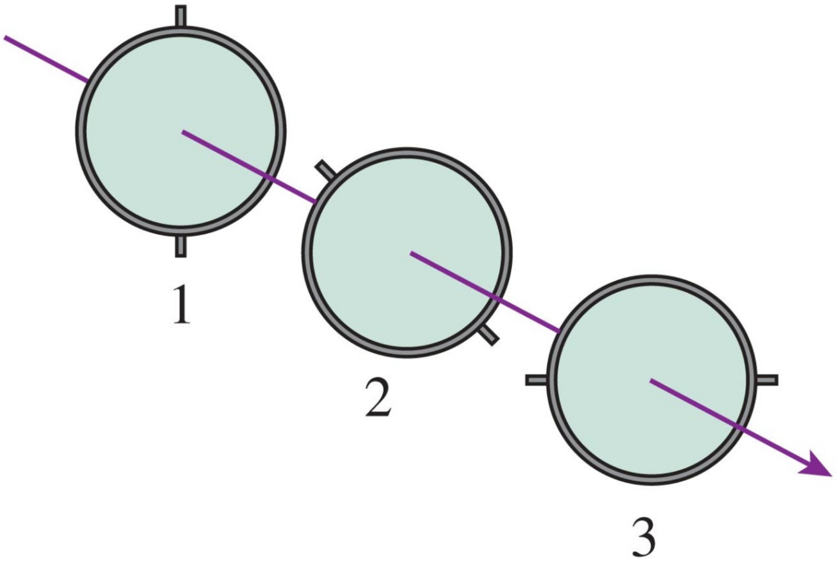
$P_{rad} = \frac{F}{A} = \frac{I}{c}$

$I = I_0\cos^2\theta$

QQ1

Unpolarized light, traveling in the direction shown, is incident on polarizer 1.

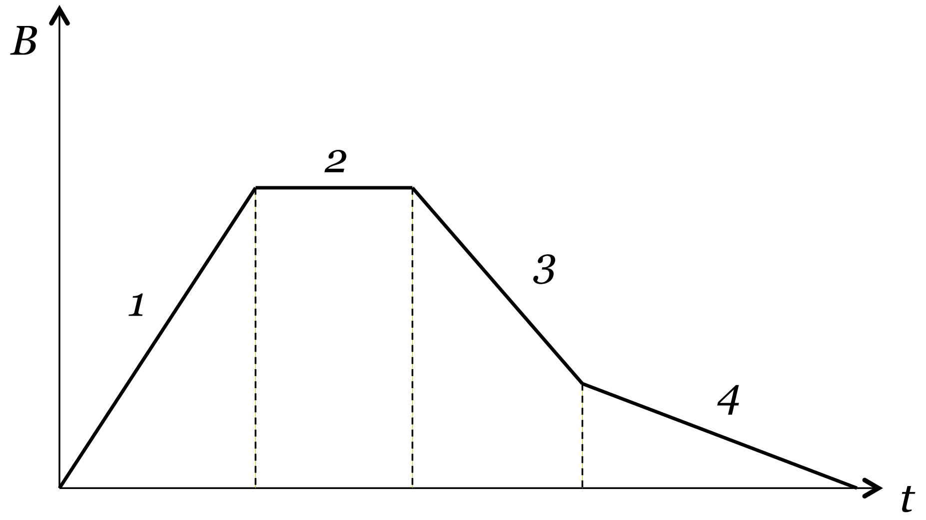
Does any light emerge from polarizer 3?



1. Yes.
2. No.

QQ2

The graph shows the magnitude of *B* that is perpendicular to the plane of a conducting loop. Rank the four regions indicated on the graph according to the magnitude of the emf induced in the loop, from least to greatest.



1. 1, 2, 3, 4
2. 2, 4, 3, 1
3. 4, 3, 1, 2
4. 1, 3, 4, 2
5. 4, 3, 2, 1

QQ3

A proton traveling *east* experiences a *B*-field that point *south*. The proton will experience a *force* in which direction?

1. south
2. north
3. west
4. up
5. down

QQ4

Two parallel wires carrying current in the same direction will:

1. attract each other
2. repel each other
3. exert no force on each other.

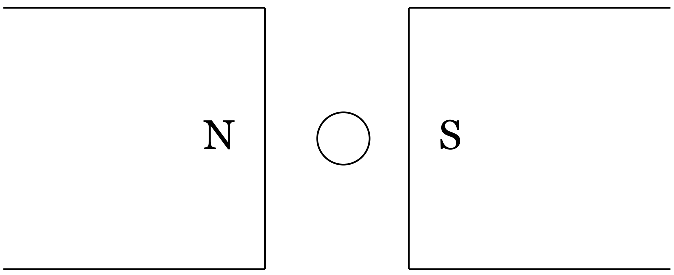
QQ5

The magnetic force on a charged particle is in the direction of its velocity:

1. If it is moving in the direction of the field.
2. If it is moving opposite to the direction of the field.
3. If it is moving perpendicular to the field.
4. If it is moving in some other direction.
5. Never.

QQ6

The diagram shows a straight wire carrying a flow of electrons into the page. The wire is between the poles of a permanent magnet. The direction of the magnetic force exerted on the wire is:



1. Up.
2. Down.
3. Left.
4. Right.
5. The wire experiences a torque, but no net force.